Parametric Estimating Software Project

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Why we studied parametrics

Determine the feasibility of developing independent Government estimates for spare parts prices

- **Improve UCA definitization timeliness**
- **Facilitate price analysis for Price-Based Acquisition & Commercial Item Contracts**
- **Reduce reliance on supplier-furnished cost/pricing data**

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Where we've been

- **January 1997 – DORO report**
  - ***Identified SEER-H and PRICE-H***
- **June 1998 - Initial software test completed**
  - ***10 DCMA offices tested 37 items***
  - ***Results varied, but showed promise***
  - ***Demonstrated need to use technical personnel***
- **October 1998 - Tasking Memorandum 99-04**
  - ***Included some new sites and some old***
- **Current test began December 1998**

Parametric Study Details

- **222 parts tested this time**
- **Actual costs obtained for 58 parts (two sites)**
- **Participating sites were: PRICE-H SEER-H**

Boeing Helicopters	Boeing Seattle
Chicago-Rockford	Boeing St. Louis
Pratt & Whitney-East Hartford	Northrop-Grumman Hawthorne
Raytheon	Raytheon-Hughes Tucson
Syracuse	Twin Cities

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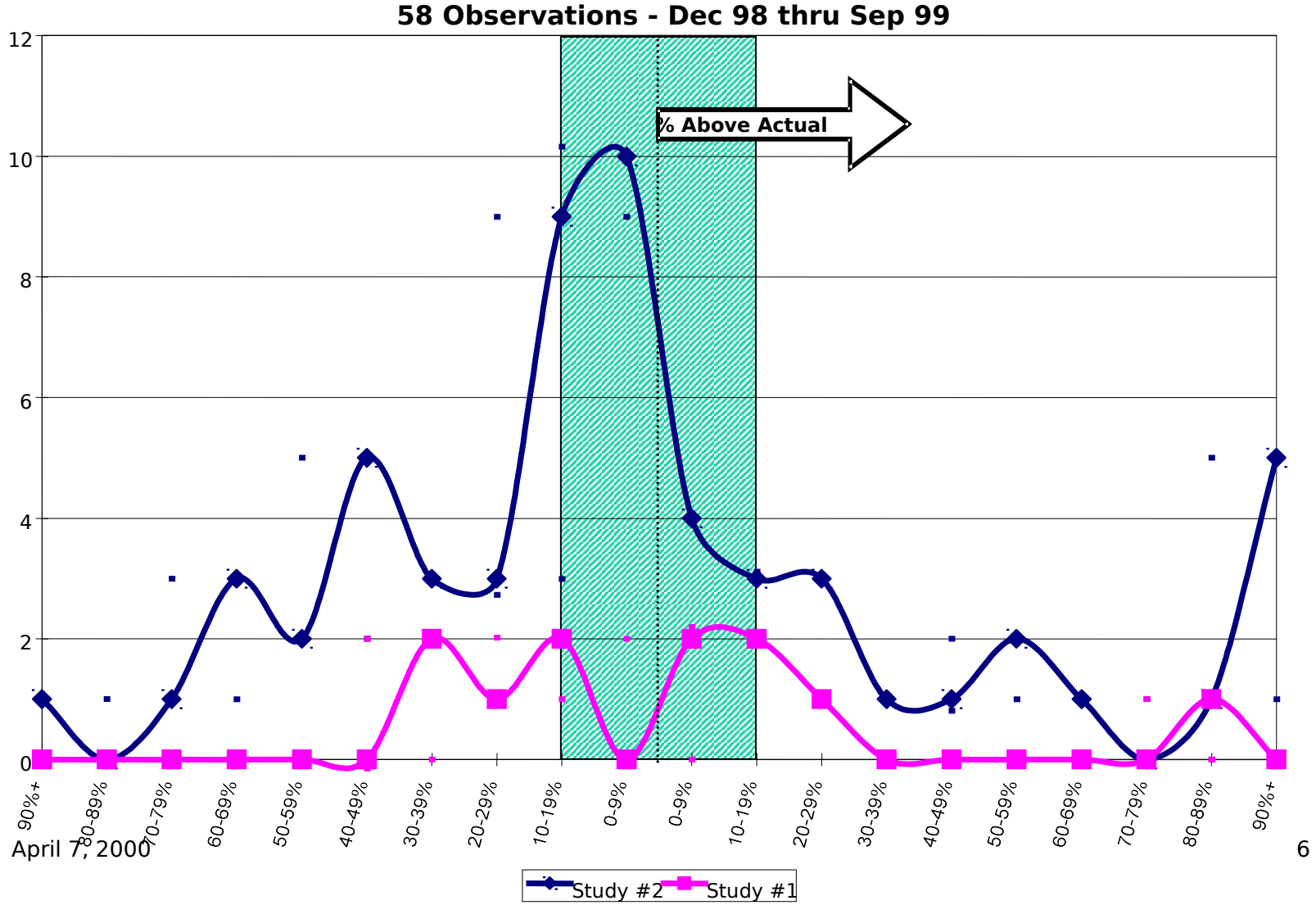
Items Tested by Site

Location	Items Estimated	Proposed	Parametric Estimate	Percent Difference
Boeing Philadelphia	50	$327,254	$182,489	-44.2%
Boeing Seattle	16	$56,927	$60,956	7.1%
Boeing St. Louis	37	$469,020	$510,179	8.8%
Chicago Rockford	33	$2,955,300	$2,508,588	-15.1%
Pratt & Whitney East Hartford	20	$63,451	$63,309	-0.2%
Raytheon	17	$110,950	$980,742	784.0%
Raytheon Tucson	23	$543,253	$583,709	7.4%
Syracuse	11	$929,257	$761,357	-18.1%
Twin Cities	13	$89,713,430	$97,516,637	8.7%
Northrop Grumman Hawthorne	2	$117,929	$88,930	-24.6%
Totals	**222**	**$95,286,771**	**$103,256,896**	**8.4%**

Parametric Study Results

Frequency Distribution: Percent Variance from Actuals



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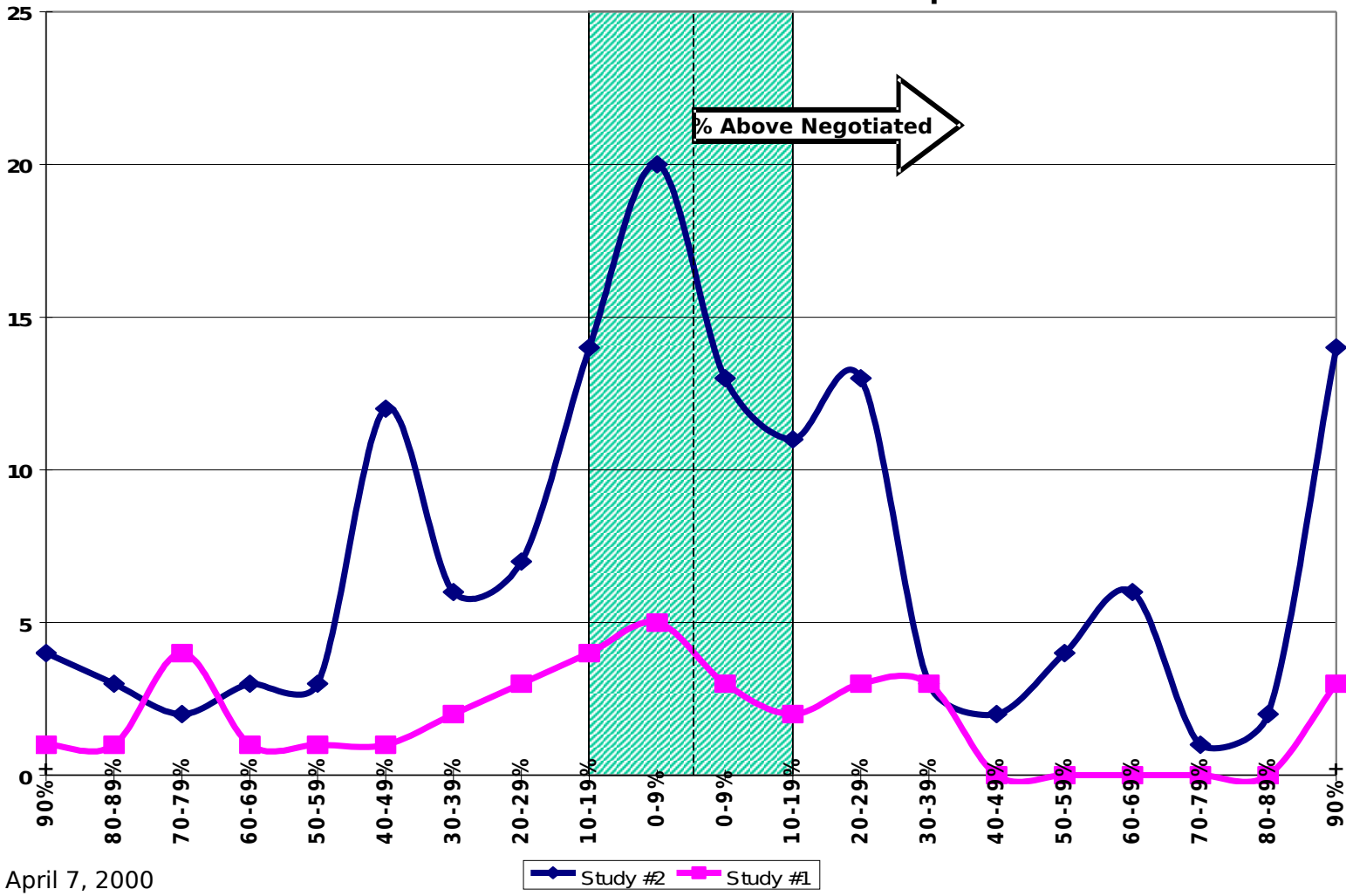
Parametric Study Results

Frequency Distribution: Percent Variance from Negotiated



Why did our results vary?

- Limited calibration
  - *Calibration data is generally not available*
    - *Accounting systems often do not collect costs for spare parts*

- Use industry averages versus company data
  - *Company labor & overhead rates may vary significantly from industry norms*

...when properly calibrated and validated, (the parametric) methodology generates excellent results.....and demands careful attention to database parameters, applications and model selection..

- J.L. Robbins & V.F. Smith

1999 Joint ISPA/SCEA Conference

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What have we learned?

- **Use the right tool for the job!**
- **Cultural issues may dictate deployment strategy**
- **Access to information is a key challenge**
- **Specialized models work better in some cases**
- **Parametrics may be the only tool in some cases**

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What have we learned?

- **Use the right tool for the job!**
  - ***Web-based procurement history can facilitate price analysis***
    - **Two commercial services evaluated**
    - **Over 80% of items covered in parametric study have adequate pricing history**
    - **Services offer critical pricing information:**
      - ***Contract numbers***
      - ***Quantities***
      - ***Prices paid***
      - ***Date procured***
      - ***Technical characteristics***
    - **Pursuing subscription to HAYSTACK**

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What have we learned?

- **Cultural issues may dictate deployment strategy**
  - ***Change in philosophy***
    - **Greater emphasis on product knowledge**
    - **Emphasis on cost estimating versus proposal evaluation**
    - **Larger role for engineer**
  - ***Lack of experience***
    - **Industry users often have 10-15 years experience**
    - **2-5 years needed to develop mature capability**
      - ***Most organizations develop capability incrementally***
      - ***Outside consultants can facilitate transition***
      - ***Large time investment to calibrate and***

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What have we learned?

- **Access to information is a key challenge**
  - ***Better access to pricing history should reduce need for independent cost estimate***
  - ***Key information needed to populate models is not readily available in many cases***
    - **Time consuming to collect information (especially when archived at other sites)**
    - **Weight and volume is biggest problem**
      - ***Sometimes estimated from drawings***
      - ***Parts may be measured & weighed (though usually not in stock)***
    - **Some technical information (materials, coatings, etc.) available through FEDLOG**
      - ***But not a reliable source***

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What have we learned?

- **Specialized models work better in some cases**
  - ***Task specific models are used for software, electronics, and other areas***
  - ***This issue became apparent at two sites:***
    - **Boeing Seattle - SEER-H**
      - ***Obtained unacceptable estimates for cable costs***
      - ***Galorath recommended use of SEER-DFM***
        - ***DFM uses more input parameters to describe part***
    - **Raytheon - PRICE-H**
      - ***Component weights below limits allowed by model***
      - ***PRICE Systems recommended use of PRICE-M***
        - ***Estimates based on inputs to circuit card components instead of weight (greater fidelity)***

What have we learned?

- **Parametrics may be the only tool in some cases**
  - ***New Items - Strength of parametrics is ability to establish price with a reasonable degree of accuracy when cost history is not available***
  - ***Frequently used by industry to identify cost drivers and conduct sensitivity analyses***

The parametric technique is most commonly used in the definition and early design stages of projects when there is insufficient information to perform a detailed estimate….attention is usually focused and concentrated on the true cost drivers….

- Joseph Hamaker, CCE/A

Cost Estimator's Reference Manual

Boeing & Whitney process

What have we learned?

- Focus is on product not organization (market value)
- Calibrate & validate model using price history
  - *Use industry average labor/overhead rates*
  - *Develop range of complexity factors for parts families across industry*
- Forward estimate using known input values
  - *Input technical characteristics*
  - *Standardize model inputs…MPI, Learning Curve*
  - *Normalize quantity and schedule*
  - *Conduct sensitivity analyses to:*
    - Identify cost drivers
    - Quantify differences
- Result is “industry average” cost

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Where are we applying the process?

ratt & Whitney process (continued)

Global Fighter/Bomber Program

- **USAF entering a new era of acquisition reform…*streamlined pricing and maybe even commercialization of some Jet Engine procurements***
- **Resource constraints and schedule requirements driving need for new pricing methodology**
- **Assumes limited access to cost data**

How are we applying the process?

ratt & Whitney process (continued)

- **Developing a parametric method for evaluating price proposals**
  - ***Independent analysis with limited or no cost data***
  - ***Process proofed during Agency test***
  - ***Method will work in price-based environment***
- **Produces a "price range" based on complexities**
  - ***May be used to establish negotiation objectives***
  - ***Initial work completed on two ECPs***

Value Pricing*...comparison of previously proposed prices as described in FAR Part 15.404-1*

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Where did we start?

ratt & Whitney process (continued)

- **Twenty-one part numbers evaluated**
  - ***44 acquisition prices over the last 10 years***
  - ***Sample included GE & PW parts***
- **Established range of calibrated complexity factors for turbine section & stages**
- **Twelve part prices estimated using the test complexity factors (validation)**
- **Validation estimates ranged from 12.6% above to 6.9% below negotiated prices**
  - ***Overall, the delta was "zero"***

What have we accomplished?

ratt & Whitney process (continued)

Engineering Change Proposals (ECP)

- **Engine Component Improvement Program (CIP) driving volume of ECPs**
- **ECP analysis includes…**
  - ***Old & new parts,***
  - ***Retrofit parts we've never bought separately, and***
  - ***Kit parts that we'll never buy again***
- **ECP turn time is very short… *impacts availability and depth of supplier data we can obtain***

Status of customer support

ratt & Whitney process (continued)

- **Two ECPs negotiated to date…**
  - ***Negotiation objectives based on value pricing and parametric estimates***
- **Third ECP in work…**
  - ***IPT formed to streamline engineering change process***
  - ***Moving toward concurrent engineering and pricing to improve cycle times***

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What we're working on

ratt & Whitney process (continued)

- **Developing a "Parametric Baseline" for production spares and engines – Global Fighter/Bomber program**
- **Provide new GE/PW and jet engine industry comparisons**
- **Expand methodology to other programs**
  - ***Research & Development* - AFRL**
  - ***Engineering Manufacturing & Development* - Joint Strike Fighter**

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Where do we go from here?

Deployment strategy:

- **Incremental deployment**
  - ***Parametrics have limited utility in some CAOs***
  - ***Develop deployment plan***
- **Establish a lead CAO for each commodity**
  - ***Avoid duplication of effort***
  - ***Facilitate exchange of information***
- **Workforce development**
  - ***Identify KSAs***
  - ***Develop training plan***

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Where do we go from here?

Deployment strategy *(continued)*:

- **Information systems**
  - ***Develop IT deployment plan***
    - **How will calibration data be stored?**
    - **How will completed analyses be stored/maintained?**
    - **Who will maintain databases?**
- **Policy/guidance**
  - ***Develop guidebook and training material***
- **Publicize achievements**
  - ***NCMA, ISPA, SCEA***
  - ***Pricing conferences***